**Bayesian Inference in Epidemiology**

**1.- The Bayesian Approach**

1.1.- Bayes theorem: its justification in probability theory and why it improves inference.

1.2.- Posterior distribution and likelihood: how to compute them and why we need to sample when models are too complex.

1.3.- MCMC sampling: very brief overview (no details) and why it is preferable to other methods if possible.

**2.- Applied Bayesian Analysis**

2.1.- Models: how to build a bespoke model based on data requirements (appropriateness of distributions) and scientific questions and hypotheses.

2.2.- Probabilistic computing: choosing a software package able to fulfil all requirements for a Bayesian workflow.

2.3. Bayesian workflow: Choosing distributions and building up a model, prior predictions, sampling and convergence, posterior assessment, posterior predictions, model comparison.

**3.- Independent Application of Bayesian Methods**

3.1.- Questions and hypotheses: selecting data and variables, structure models so questions can be answered.

3.2.- Analysis: apply a Bayesian workflow and make decisions based on output: Are selected priors a good choice for the model? Did models converge? Do posteriors look sensible? Are posterior predictions reasonable? If more than one model, how can I compare and select which model is best?

3.3.- Results and interpretation: how to reason through results and explain what they mean. How to make inferences.

**Reading**

Lawson, A. B. (2008). Bayesian Disease Mapping. CRC Press: Chapters 5.1.4 and 5.2 .

McElreath, R. (2020). Statistical Rethinking: A Bayesian Course with Examples in R and Stan (2nd ed.). Chapman and Hall/CRC: Chapter 11.2 .

**Further Reading**

Gelman, A., Vehtari, A., Simpson, D., Margossian, C. C., Carpenter, B., Yao, Y., Kennedy, L., Gabry, J., Bürkner, P.-C., & Modrák, M. (2020). Bayesian Workflow. Arxiv.org. <https://arxiv.org/abs/2011.01808> .

Martin Osvaldo A, Kumar Ravin; Lao Junpeng (2021). Bayesian Modeling and Computation in Python Boca Ratón: Chapter 9.

**Further Watching**

McElreath, R. (2020, February 5). Bayesian Inference is Just Counting. Www.youtube.com. <https://www.youtube.com/watch?v=_NEMHM1wDfI>

McElreath, R. (2023a, January 4). Statistical Rethinking 2023 - 02 - The Garden of Forking Data. Www.youtube.com. <https://www.youtube.com/watch?v=R1vcdhPBlXA>

McElreath, R. (2023b, February 1). Statistical Rethinking 2023 - 10 - Counts & Hidden Confounds. Www.youtube.com. <https://www.youtube.com/watch?v=jokxu18egu0>